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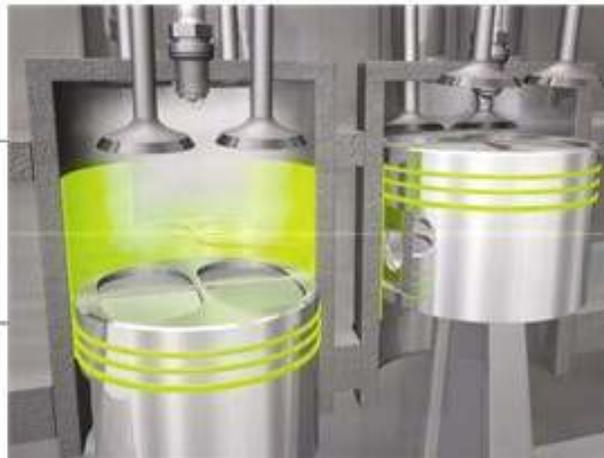
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Nano-Technology

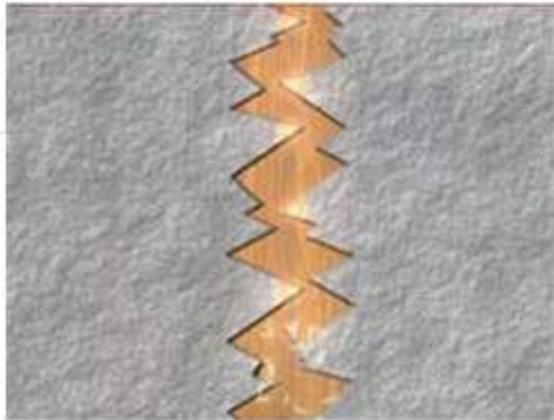
Reconditioning and durable wear protection for metal surfaces in tribologic systems

A unique possibility

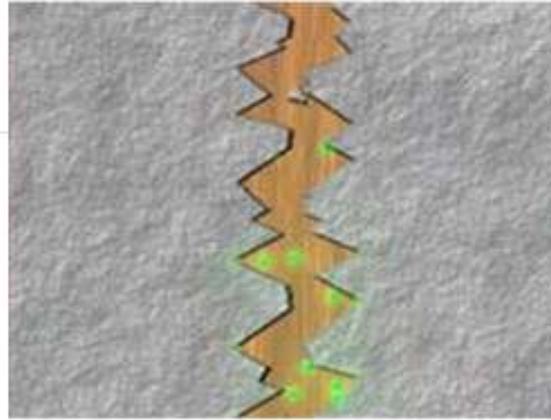
**to coat, to protect and to recondition new and worn out
metal surfaces!**



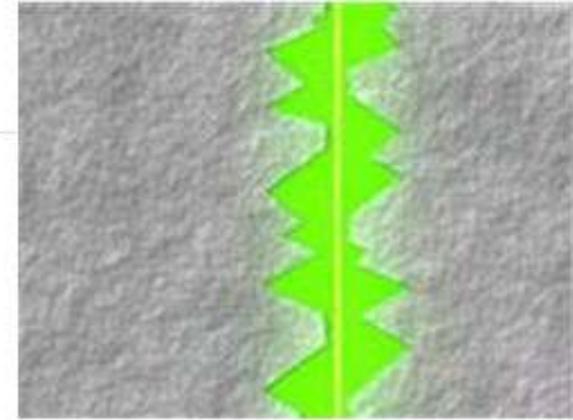
Technology: The coating process



Friction and pressure in engines and gearboxes generates high temperatures on metal surfaces that trigger the chemical bonding process



The soft Nanoparticles remove dirt from the rubbing metal surfaces and react with the metal atoms to form a smooth and protective layer on the surface.



The final result is a new and very smooth metal surface structure. These properties, in turn, give the machine more power, higher efficiency and longer life.

Targets of Nano Coating Technology within the Motor Industry

Replacement of the friction pair “metal-metal” by “metal ceramic-metal ceramic”

Advantages:

- ➔ Reduction of abrasion and wear of rubbing metal surfaces
 - ➔ Coating process during system is running, without down time
 - ➔ Obvious improvement of the original material properties
 - ➔ Prolongation of machine life time
-

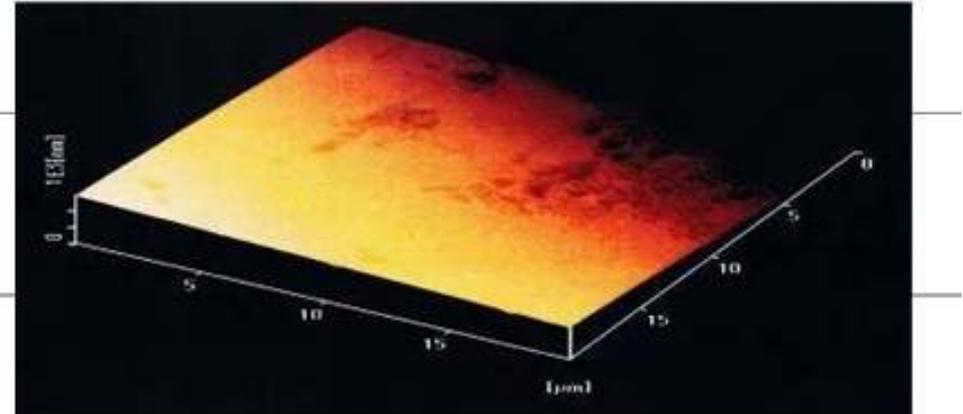
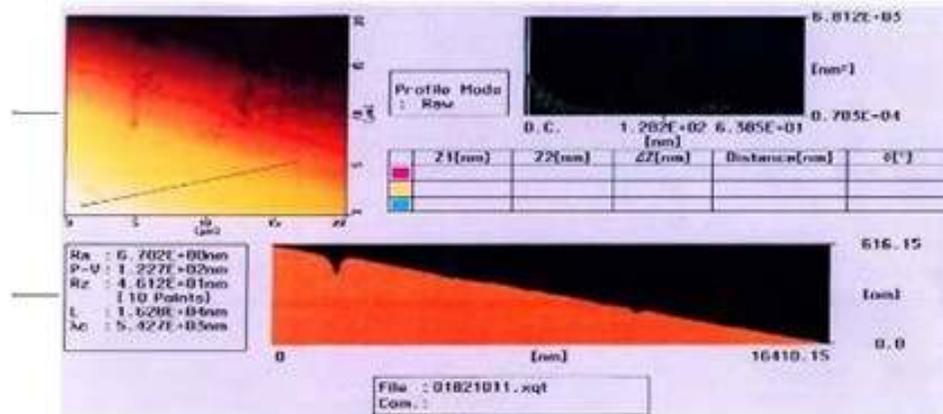
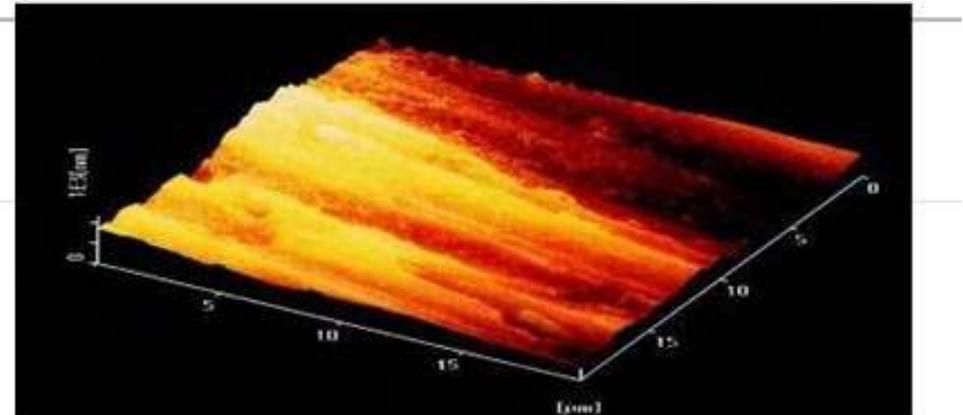
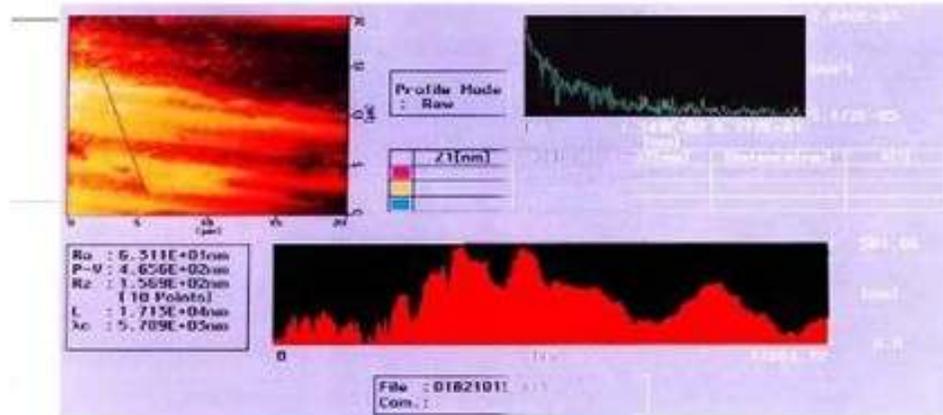
Advantages of NLG Nano-coating Technology

- ➔ Reduction of friction, vibration and noise
- ➔ Extension of lifetime
- ➔ Reduction of repairs
- ➔ Prolongation of maintenance intervals
- ➔ Improvement of efficiency:
- ➔ Savings of energy and fuel up to 11 %
- ➔ Reduction of emissions (Diesel soot, CO₂, HC und NO_x)
- ➔ Emergency running properties in case of oil loss

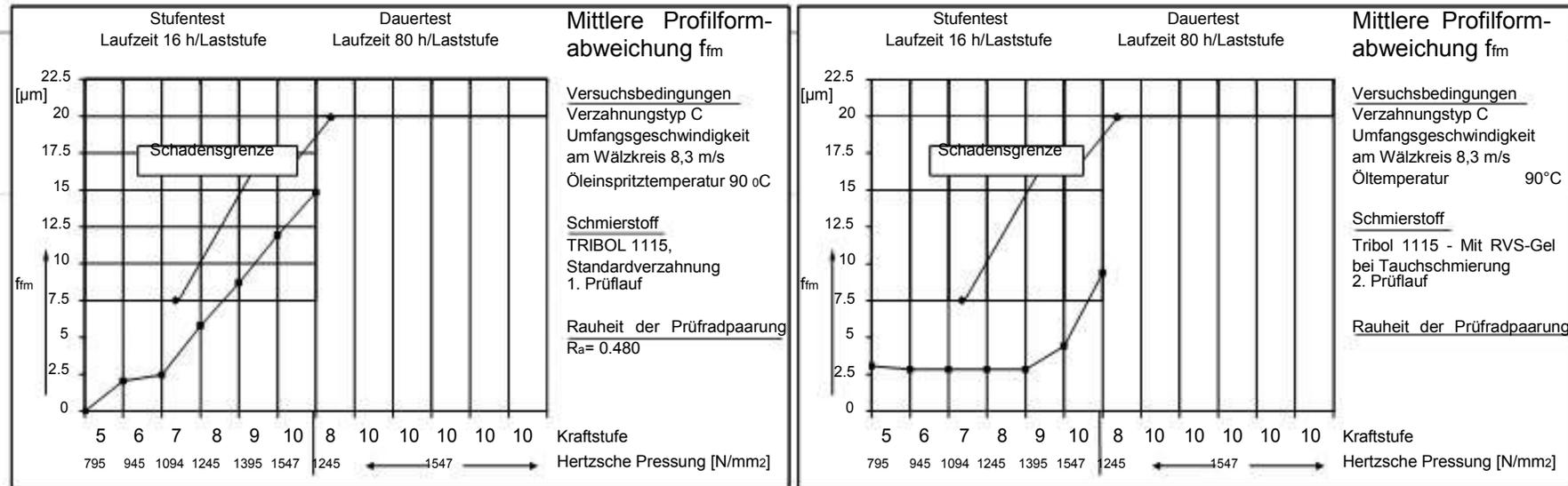
Damages at gears



Gear before and after Treatment



Tests at University in Bochum

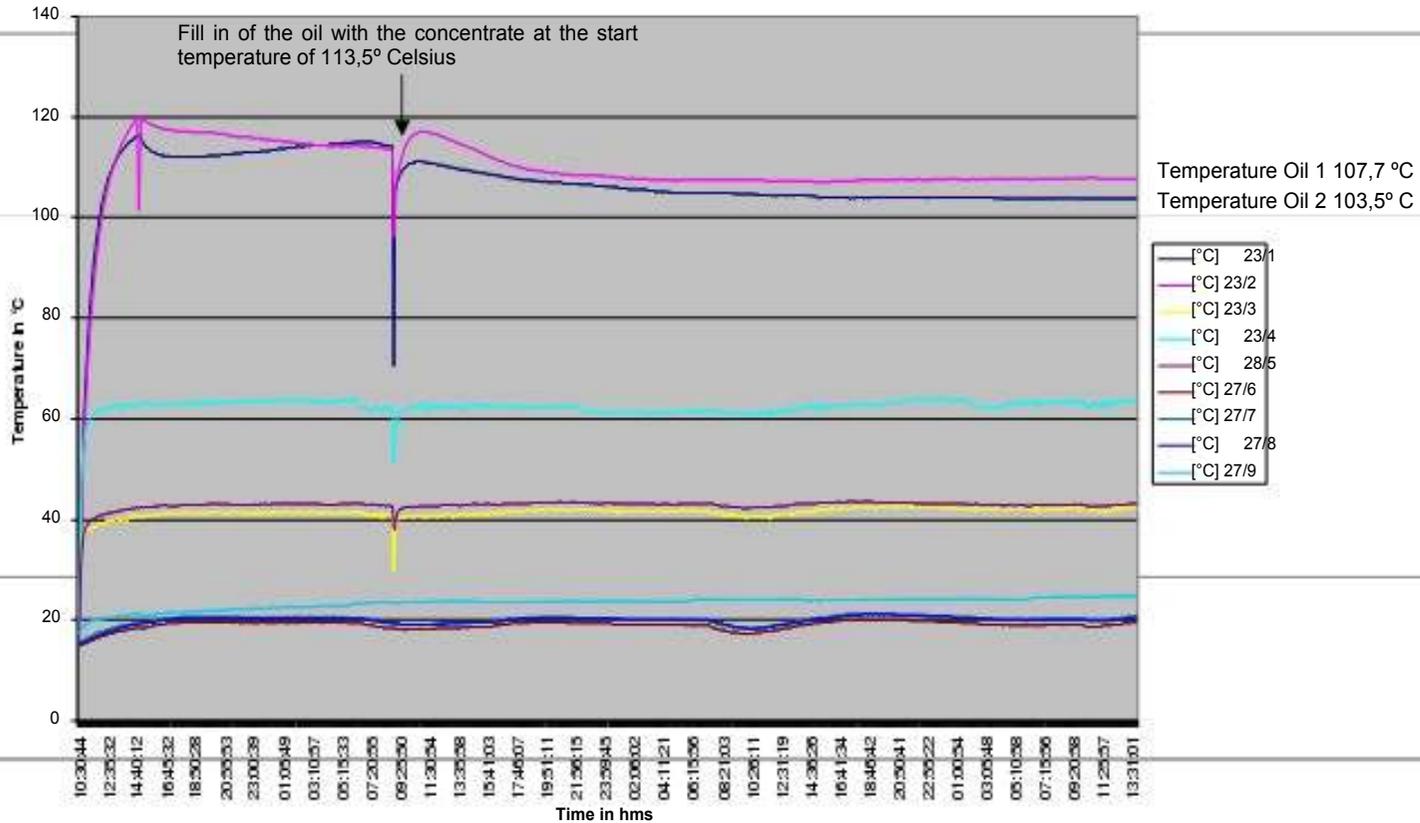


FVA Micropitting Test

Results: Increase of 2 load steps, reduction of roughness by 17%, reduction of changing profile by 37%, reduction of pitting area by 8% and reduction of weight loss by 30%!

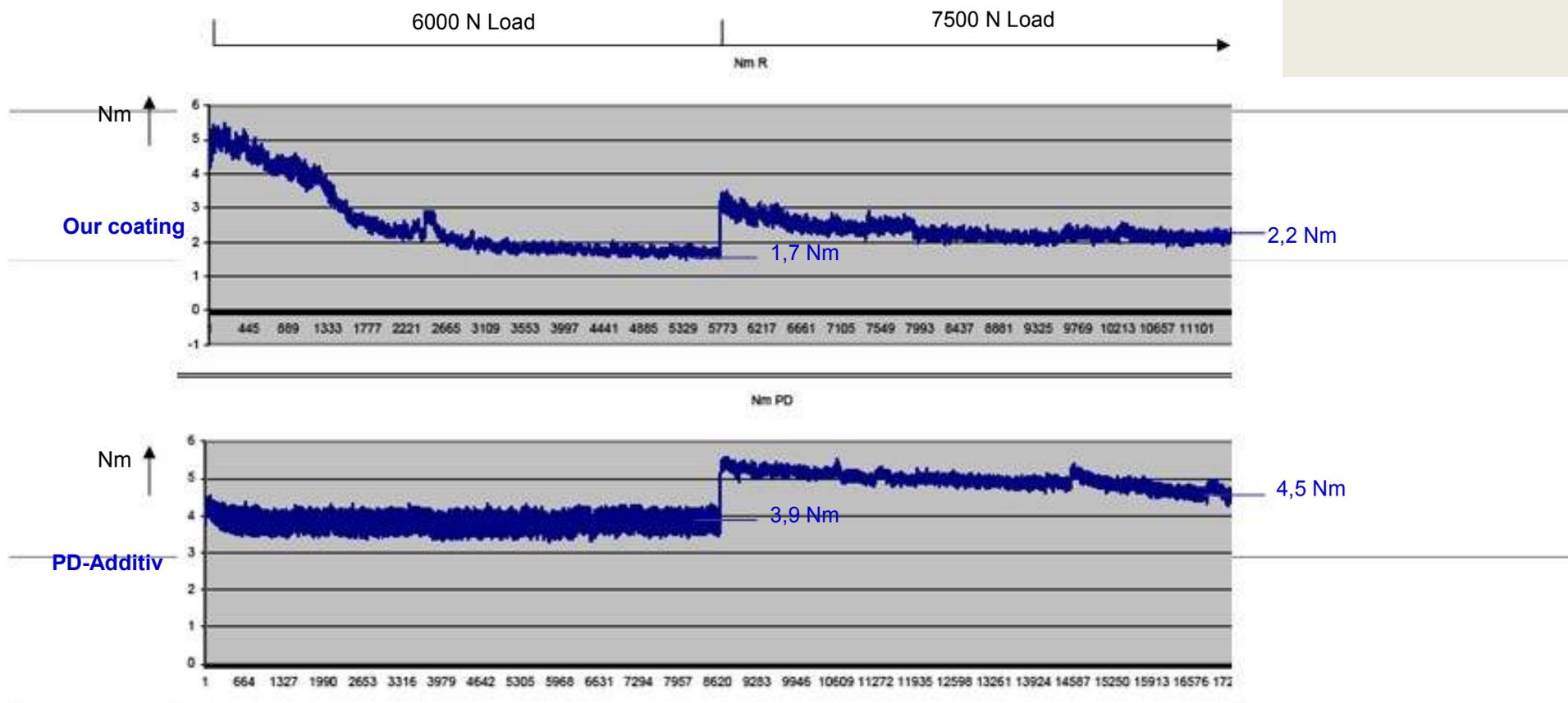
Test on 2 gears of company Tandler

HL HWS A1 3.1 III
Tests with Nano-coating



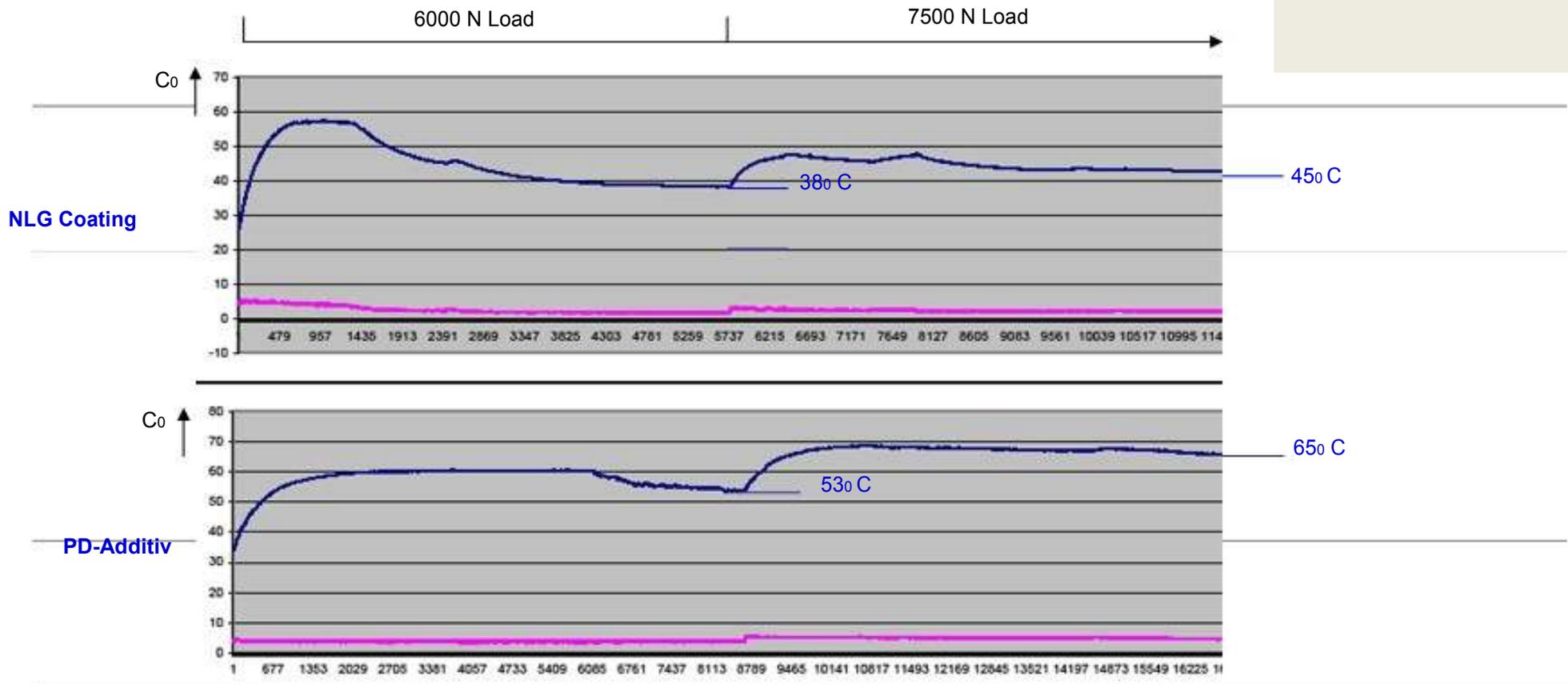
Temperature trend of the 2 Tandler gears with 2 different oils with and without NLG Coating
- Temperature reduction of 6 - 10 °Celsius

Comparison at Bearing Test Bench 1: Our NLG Nano-coating versus PD (Plastic Deformation) Additive



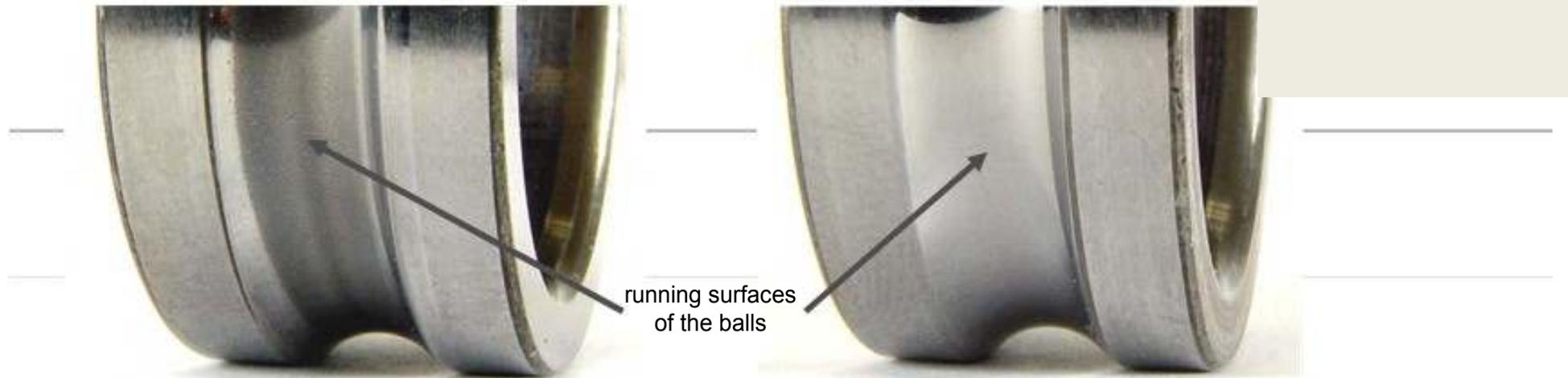
Torque regime at 2 roller bearings 3205: oru coating versus PD-Additiv with different load
Result: Torque reduction of about 2,3 Nm, due to less friction in the bearing.

Comparison at Bearing Test Bench 2: Our NLG Nano-Coating versus PD (Plastic Deformation) Additive



Temperature regime at 2 roller bearings 3205: NLG Nano-coating versus PD-Additiv with different load
Result: Temperature reduction of 15 -20° Celsius, due to less friction in the bearing!

Load Test of Ball Bearings



Photos of the inner races of two ball bearings after 50 hours of operation in a range of fatigue

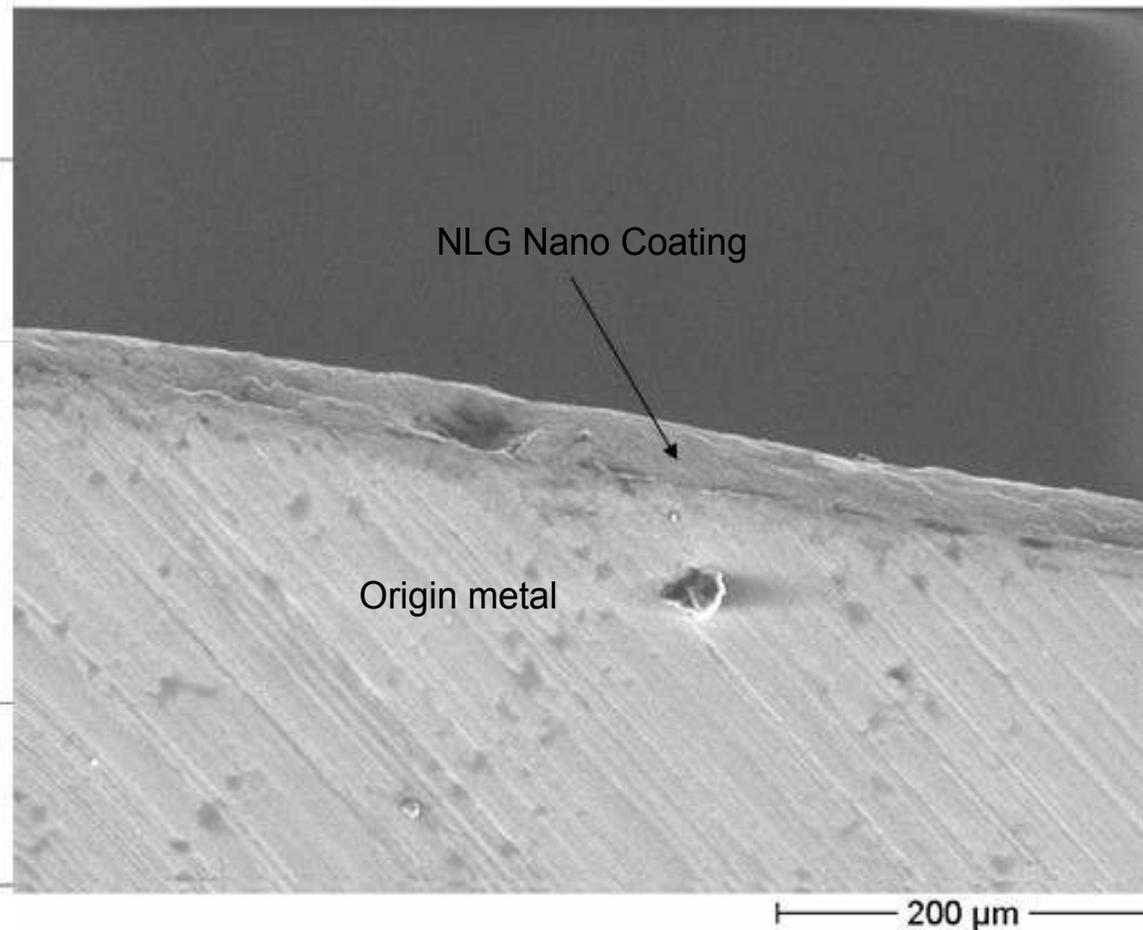
This ball bearing shows damage due to wear and tear. The running surface of the balls clearly shows pitting

This ball bearing does not show any wear. The running surface of the balls clearly shows a wear resistant coating.

Bearing type: No. 6205 (d=25mm D=52mm)
Lubricant: Special bearing grease
Operating time: 50 hours
Rotational speed: 500 min⁻¹
Nominal load: 5000 N radial (range of fatigue)

Bearing type: No. 6205 (d=25mm D=52mm)
Lubricant: Special bearing grease **treated with NLG Coating**
Operating time: 50 hours
Rotational speed: 500 min⁻¹
Nominal load: 5000 N radial (range of fatigue)

Microsection of a ball bearing surface



The microsection shows the running surface of a ball bearing of a planet gear box after 250 hours of operation in an area of fatigue. The NLG Nano Coating up to 30μm could be obviously recognized.

Range of NLG applications



Range of NLG applications

Industry:

Gears

Combustion engines

Compressors

Bearings

Hydraulic pumps/ -motors

Vacuum pumps

Chain drives

Gear racks, pinions



Range of NLG applications

Utility vehicles:

Gasoline- and diesel engines
Gears
Rear axles, differentials
Universal shafts
Compressors
Roller- slide bearings

Railways:

Diesel engines
Gears
Compressors
Bearings



Range of NLG applications

Ships:

Main engines (2-stroke, 4-stroke)

Auxiliary engines

Main-, winch-, crane- and
rudder gears

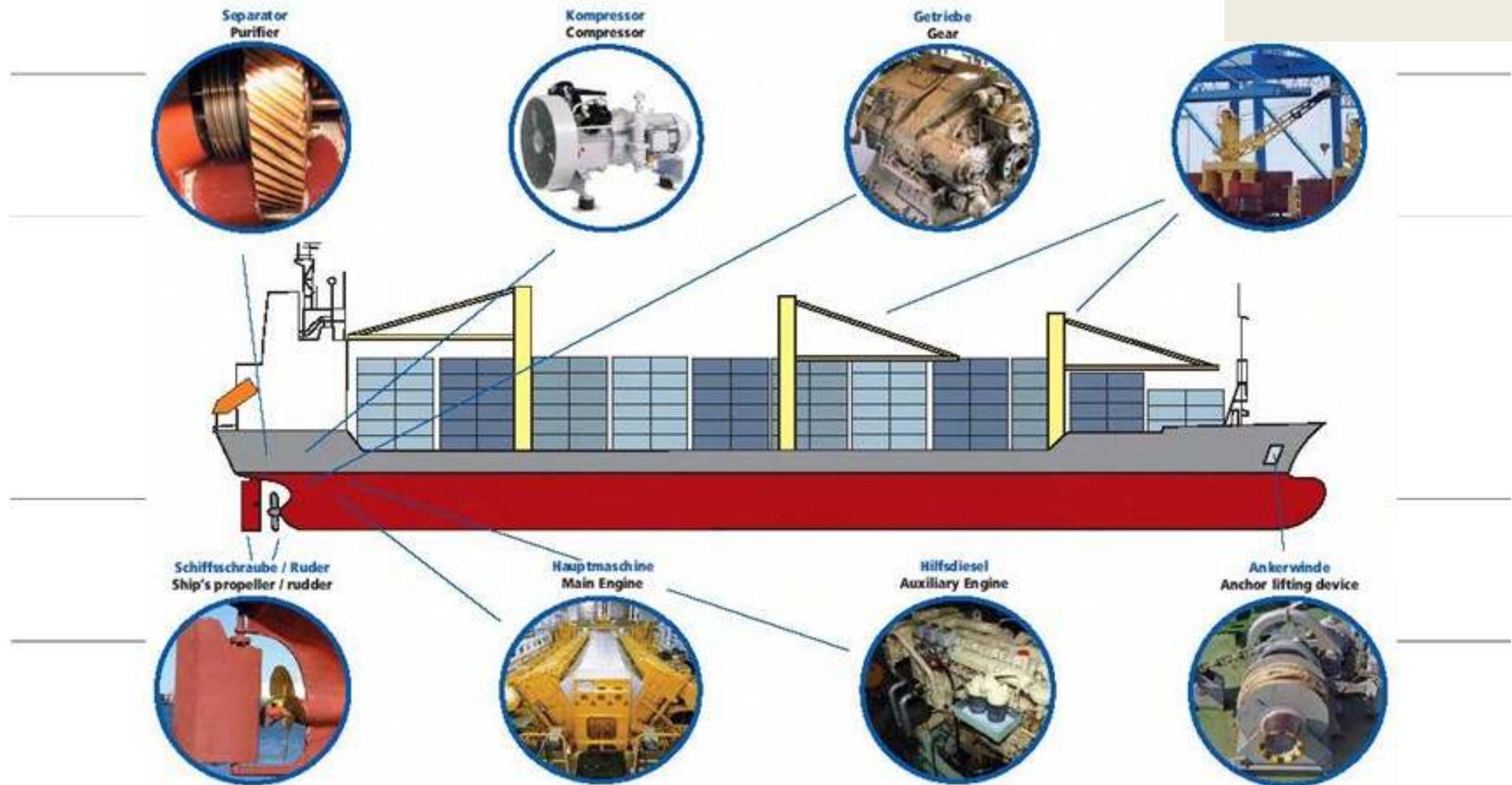
Separators

Compressors

Bearings



NGL applications in shipping business



Range of NLG applications

Automotive:

- Gasoline- and diesel engines
- Gears, rear axles
- Universal shafts
- Bearings



Test report of University of Applied Science Frankfurt

VW Passat 1,9 TDI:

Die University of Applied Science in Frankfurt examined on a VW Passat 1,9 TDI the effects of a engine treatment M2 and a gear treatment G5 in relation to fuel consumption and emissions.



Hersteller	Volkswagen	Typ	Passat TDI
Km-Stand	147.700 (19.12.2006)	Hubraum	1900 ccm
Leistung	96 kW / 4000 Umin ⁻¹	Erstzulassung	25.07.2002
Motor	Diesel – Euro 3		

Test report of University of Applied Science Frankfurt



Results:

- ➔ All measurements were showing a noticeable decrease in fuel consumption up to **11 %!**
- ➔ Furthermore there was also a decrease of CO₂- und particle emissions!

Messung	Datum	NEFZ	60 km/h	90 km/h	110 km/h	km-Stand
	Verbrauch	l /100 km	l /100 km	l /100 km	l /100 km	
1.	19.12.2006	∅ 6,79	5,93	6,23	7,10	147.700
2.	14.02.2007	∅ 6,08	5,33	5,88	6,56	151.300
	Minderung	- 11%	- 11 %	- 6 %	- 8 %	

Test report of University of Applied Science Frankfurt

VW Touran:

Together with a taxi company in Frankfurt/ Germany the University of Applied Science investigated the influence of M2 to the fuel consumption and emissions on a VW Touran.



Hersteller	Volkswagen	Typ	Touran
Km-Stand	160.218 (30.05.2007)	Amtl. Kennz.	F – TX 1502
Hubraum	1968 ccm	Getriebe	Automatik, 6 Stufen
Leistung	103 kW / 4000 Umin ⁻¹	Erstzulassung	21.02.2005
Motor	Diesel – Euro 4		

Test report of University of Applied Science Frankfurt



Results:

➔ Reduction of fuel consumption up to **4,2 %!**

➔ Reduction of particles exhaust of **63,6 %!**

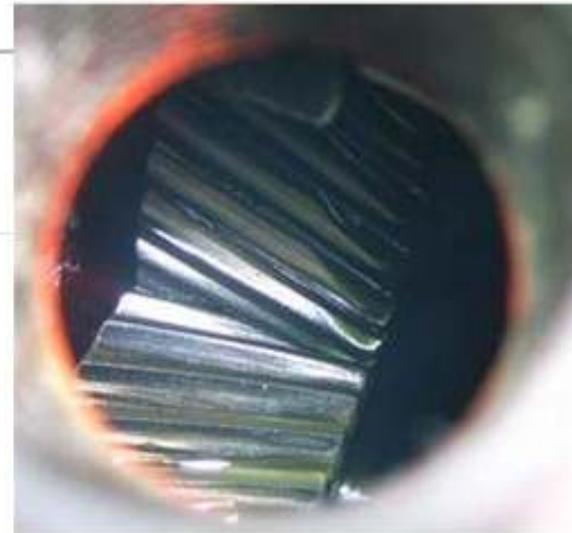
Messung	Datum	NEFZ	90 km/h	110 km/h	Partikel)*	km-Stand
	Verbrauch	l /100 km	l /100 km	l /100 km	g/km	
1.	30.05.2007	6,59	5,59	7,13	0,077	160.218
2.	13.06.07	6,31	5,47	6,95	0,028	164.450
	Minderung	- 4,2 %	- 2,2 %	- 2,5 %	- 63,6 %	

Tabelle 2: Ergebnisse Verbrauchs- und Partikelmessung,)* Partikelmessung nur im NEFZ

NLG Nano Coating Technology in practise



Treatment of 2 drill head gears at Volkswagen engines production line in Salzgitter



Problem:

Short lifetime, extreme high costs in case of idleness and breakdown (>25.000,-€), higher oil temperature (51°C). Emergency run problems due to oil leakage.

Result:

Oil and oil filter are clean with nearly no metal particles. After NLG Nano-coating oil temperature was reduced by about 6°C to max. 45°C. Due to a system leakage drilling emulsion went into the gearbox. The NLG Nanocoating prevented the system against damages.

Treatment of a thermal power station from Sachs



Problem:

Extreme high oil consumption, loud noise and high costs of repair

Result:

Decrease of oil consumption during 2.700 rhs from 7 litres to 1 litre. Obvious reduction of noise. Cost savings due to the NLG Coating treatment of about 1.600,00 €!

Treatment of a diesel locomotive of SBB



Problem:

NLG Nano-coating treatment of diesel engine (1.320,- EUR) in competition and relation to a normal revision W6 according to MTU/Mercedes specifications (30.000,- EUR).

Result:

Better engine power and reduced noise with NLG Nano-coating treatment. Full availability and a lot of cost saving.

Treatment of a cooling compressor

Problem:

- Compressor was running with high wear noise on the valve plates
- No spare parts available, machine ought to be scrapped
- Investion of 300.000,- EUR was necessary!

Result:

After the first NLG Nano-coating treatment and 20 minutes running time the compressors noise was obvious reduced. After the second treatment and about 10 running hours the wear noise disappeared completely!



Treatment of a conveyor belt gearbox at Kali & Salz

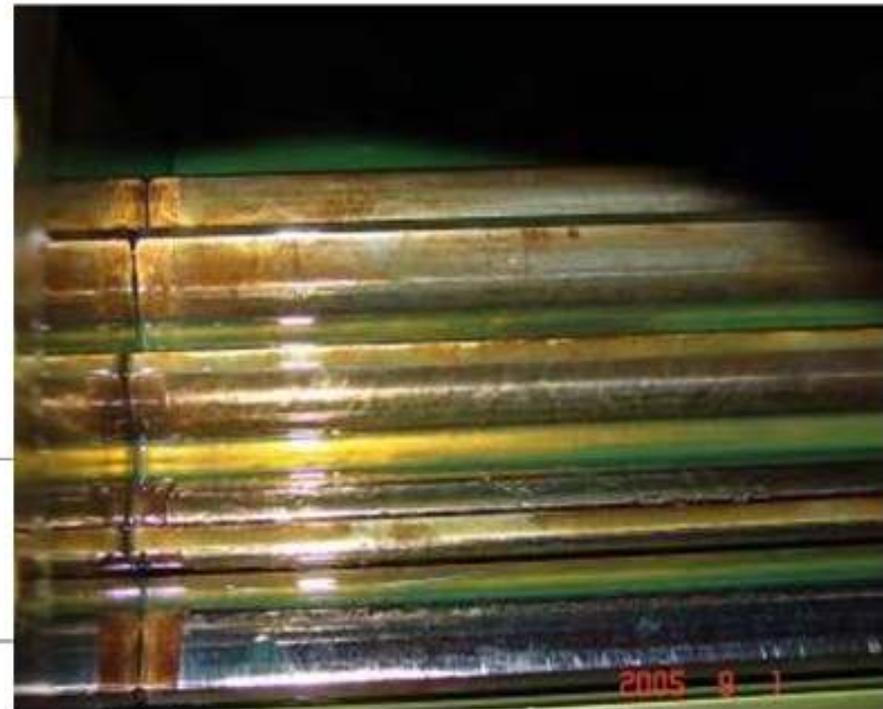
Problem:

Worn out and corroded gear teeth,
cracked and welded bearings

Target of application:

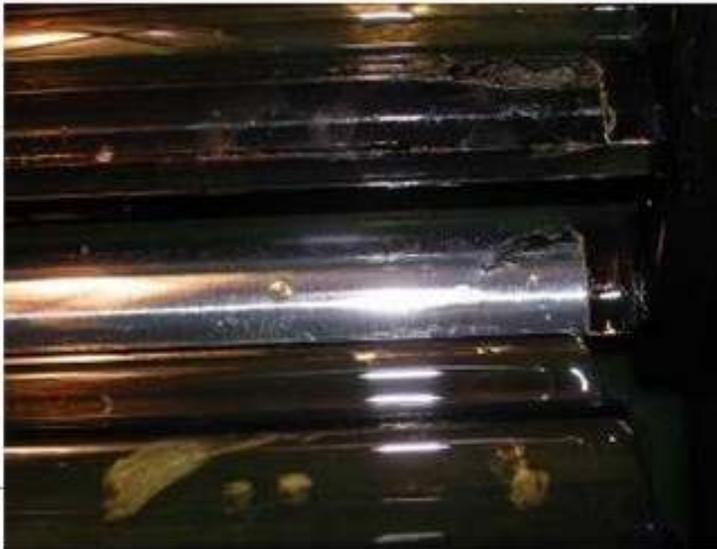
Prolonging lifetime of the damaged
gearbox until exchange gearbox was
available.

before treatment:



Treatment of a conveyor belt gearbox at Kali & Salz

After treatment:



After the treatment:

Shiny and coated teeth surfaces. The cracked and welded roller bearing was running for 1 year as a slide bearing. The exchange gearbox was standing beside during this time for emergency cases.

Treatment of a presses gearbox at Kali & Salz

Treatment of a presses gearbox for fertilizer granulate production

Problem:

Gear wheels were exchanged every 7
-9 months for 70.000,- EUR.

Solution:

After the single treatments we recognized
the closing of the surface pittings and the
enlargement of the load carrying area. The
gearbox is still in use.

vor der Behandlung 29.06.2005



nach der ersten Behandlung 05.07.2005



nach der zweiten Behandlung 16.08.2005



nach dem Ausbau 16.01.2006



Coating of a wind power station gearbox TW250



Goal of application:

- Rebuilding of worn out teeth surfaces
- Reduction of grey stoking
- Protection against further wear and prolongation of life time

Results after about 700 hours operating time:

- The teeth surfaces are much smoother and more shiny (replicas before and after)
- The damages are without sharp edges
- The coated teeth surfaces had a higher electrical resistance of about 50 Ω

Coating of a wind power station gearbox TW600



Goal of application:

- Reduction of grey stoking
- Protection against further wear and prolongation of life time

Condition after 64 days operating time:

- The teeth surfaces are much smoother and more shiny (replicas before and after)
- The damages are without sharp edges
- The coated teeth surfaces had a higher electrical resistance of about 100 Ω

Treatment of a inland going vessel



Problem:

High oil consumption, engine and gearbox in bad condition

Result:

NLG Nano-coating Treatment of engine, power supply and gearbox. ZF reverse gear unit was running more silent and soft. Oil consumption of the engine was reduced from 4,0 litre to 2,5 litre during 24 hours (90 % load). Oil consumption of the power supply was reduced from 0,6 litre to 0,3 litre during 24 hours.

Treatment of compressors and separators of Hapag Lloyds „Tokyo Express“



Problem:

Carbonization of the valves due to water in the oil caused by different air humidity. High oil temperatures, damages of valves, piston and rings.

Solution:

NLG -Nanocoating reduced the internal friction and oil temperature. Carbonization and wear was reduced. Lifetime of valves, piston and rings were doubled.

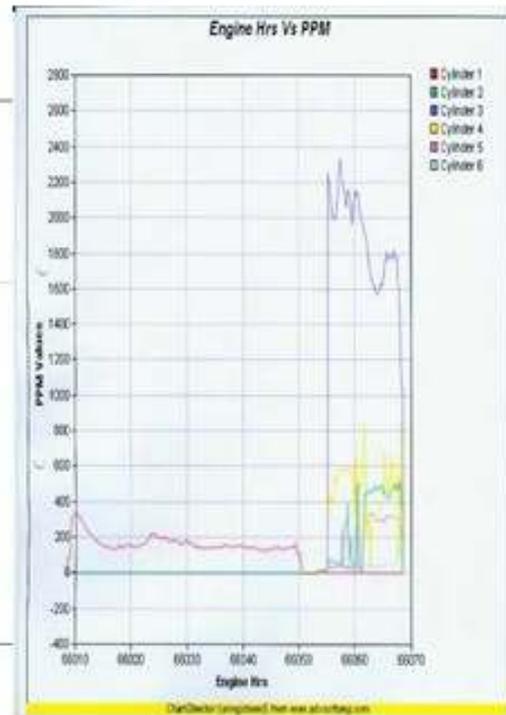
Treatment of Sulzer 2-stroke engine 6 RTA 62U of “MV Gloria”



Problem: Strong cylinder liner and piston ring wear after 18.000rhs, due to bad fuel and material problems. Piston ring wear was recorded via a monitoring system.

Solution: Cylinder liner and piston ring life time was extremely improved to >30.000rhs. The monitoring system recorded a coating on liner and rings.

Treatment of one cylinder of a Sulzer 2-stroke engine 6 RTA 62U



Problem: Strong cylinder liner and piston ring wear after 18.000rhs, due to bad fuel and material problems. Liner wear was recorded via a condition monitoring system.

Solution: Cylinder liner wear and piston ring life time was extremely improved. After 2.5 years CMS detects nearly no wear in the scrape down oil in cylinder 6.

Treatment of 2 GMT auxiliary engines of the “Alfred N”



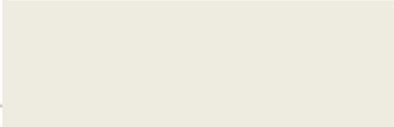
Problem:

Extreme high lube oil consumption of the 2 auxiliary engines GMT 230.P8BL, 99,7 ltr. cylinder capacity

Solution:

The NLG Nanocoating improved the static cylinder compression and lube oil consumption was reduced with 20%!

Present Users



				Hatlapa Marine Equipment
	Fachhochschule Frankfurt am Main University of Applied Sciences			EnBW Die Energie-AG.